Nonchemical means of pest control include (1) the use of plant varieties that are resistant to pest damage, (2) cultural methods such as physical destruction of crop residues (Reynolds et al., 1975) or early harvesting (Shoemaker and Onstand, 1983), and (3) biological control by predators, pathogens, and other natural or introduced enemies of the pest. Another means of non-chemical pest control is "microbial pesticides" like Bacillus thurengiensis (BT). BT, a pathogen that attacks lepidopterous insects, is applied like a chemical pesticide. A classic example of a successful integrated program has been developed in Texas for control of insect pests of cotton. The program is based on the use of a new variety of cotton that develops more quickly and hence can be harvested before the boll weevil can cause serious damage. The program also promotes the use of a type of pesticide and a timing for applications that are designed to protect as much as possible the natural enemies of the boll weevil. Masud and Lacewell (1985) reviewed cotton insect IPM programs throughout the United States and concluded that IPM is profitable and reduces pesticide use. In a review of six on-farm insect, disease, and weed IPM programs, Lacewell and Masud (1985) concluded that all reduced insect treatments. Profit was increased in all cases, the increases ranging from $3 to $186 per acre. They also state that IPM control strategies for major insect pests in Michigan increased growers* profits between 16 and 46 percent.

Integrated pest management programs have not been developed for all pests. Although a great deal of work has been done for foliar insect pests, research on IPM for nematodes and weeds has only begun recently and relatively few programs have been developed and implemented. From the point of view of ground water contamination, this is unfortunate since pesticides associated with nematode and weed control tend to be among the most commonly found pesticides in ground water. Solubility and persistence, and the chemical characteristics that promote effective control of nematodes and weeds, are also characteristics that increase the potential of a pesticide to reach ground water. Crop rotation is one method to reduce the need for nematicides.

Integrated Pest Management (IPM) programs for nematodes and weeds in cotton and alfalfa have recently been developed, and they do show promise for cost-effective pest control with a reduced level of pesticide use. Given the demonstrated success of IPM in reducing pesticide use for foliar insect control, research programs should be supported to develop IPM methods for other pests that are responsible for the application of pesticides that have the propensity to migrate into ground water. Such programs usually take several years to develop and many more years to be widely implemented. Hence, although IPM is a very attractive long-term alternative, shorter-term methods for pesticide use reduction must also be considered.